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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

Attorney Docket No. 17924/301

First Inventor James S. Bernardo

Title System for Monitoring and Testing of Light Sources

Express Mail Label No. EM388584951US

ADDRESS TO:

Assistant Commissioner for Patents

Box Patent Application

Washington DC 20231

1. ☒ *Fee Transmittal Form (e.g. PTO/SB/17)
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2. ☒ Specification Total Pages (14)
(preferred arrangement set forth below)
 - Descriptive title of the invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to Microfiche Appendix
 - Background of the Invention
 - Brief Summary of the Invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
3. ☒ Informal Drawing(s) (35 U.S.C. 113) Total Sheets (3)
4. ☒ Oath or Declaration
 - a. ☒ Newly executed (original or copy)
 - b. ☐ Copy from a prior application (37 C.F.R. § 1.63(d))
 - i. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

5. ☐ Microfiche Computer Program (Appendix)
6. Nucleotide and/or Amino Acid Sequence Submission
(If applicable, all necessary)
 - a. ☐ Computer Readable Copy
 - b. ☐ Paper Copy (identical to computer copy)
 - c. ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. ☐ Assignment Papers (cover sheet & document(s))
8. ☐ 37 C.F.R. § 3.73(b) Statement ☐ Power of Attorney
(when there is an assignee)
9. ☐ English Translation Document (if applicable)
10. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
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12. ☒ Return Receipt Postcard (MPEP 503)
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Statement(s) Status still proper and desired
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Signature	<i>Craig J. Lervick</i>	Date	8-1-00

UTILITY PATENT
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE



Applicant : James S. Bernardo

Ser. No. :

Filed :

Title : SYSTEM FOR MONITORING AND
TESTING OF LIGHT SOURCES

Docket No : 17924/301

CERTIFICATE OF EXPRESS MAIL

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Date of Deposit: August 1, 2000

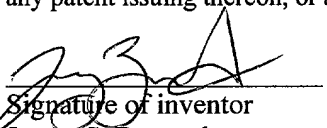
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- ☒ Specification 12 page(s)
- ☒ Claims 1 page(s)
- ☒ Abstract 1 page(s)
- ☒ Drawings 3 page(s) INFORMAL
- ☒ Declaration & Power of Attorney 1 page(s)
- ☒ Small Entity Statement Declaration – 1 page
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By: _____

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VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) & 1.27(b))--INDEPENDENT INVENTOR	Docket No. (Optional) 17924/301
<p>Applicant or Patentee: James S. Bernardo</p> <p>Application or Patent No.:</p> <p>Filed or Issued:</p> <p>Title: System for Monitoring and Testing of Light Sources</p> <p>As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in:</p> <p><input checked="" type="checkbox"/> the specification filed herewith with title as listed above.</p> <p><input type="checkbox"/> the application identified above.</p> <p><input type="checkbox"/> the patent identified above.</p> <p>I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).</p> <p>Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:</p> <p><input checked="" type="checkbox"/> No such person, concern, or organization exists.</p> <p><input type="checkbox"/> The person, concern or organization is:</p> <p>Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)</p> <p>I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))</p> <p>I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.</p> <p>  Signature of inventor James S. Bernardo </p> <p>Dated: <u>July 31</u>, 2000</p>	

SYSTEM FOR MONITORING AND TESTING OF LIGHT SOURCES

BACKGROUND OF THE INVENTION

Field of the Invention

5 The present invention relates to a system for monitoring light sources. More particularly, the present invention relates to a system for sensing the condition and efficiency of various light sources, or luminaires, and reporting this information to a monitoring station.

Description of the Related Art

10 There are a wide variety of lighting sources or luminaires that are critical to the operation of their associated infrastructure. For example, the proper functioning of traffic lights is absolutely essential to the safety and management of countless people each day. Likewise, street lights and other overhead outdoor luminaires allow for safe and convenient travel during night time conditions. While the reasons for maintaining proper lighting conditions in various indoor and outdoor facilities is important for certain obvious reasons, the nature of those facilities
15 sometimes makes proper maintenance an even more critical aspect. For example, various banks provide ATM machines in a plurality of different types of locations. Since these machines will function to draw traffic dealing in cash transactions, it is desirable to maintain these machines in a safe and well-lit condition. That is, if the lighting should fail in such an area, people obtaining cash from ATMs may be at a higher risk for crime and possibly personal attack.

20 Thus, there exists a distinction between lighting provided for convenience and lighting provided for safety and necessity. In those systems where lighting becomes more critical, the proper functioning of the luminaire takes on more importance and significance. Thus, there

exists a need to provide a system that monitors the performance of these critical luminaire systems and provides a way to indicate potential problems to managing authorities.

In other situations, it is beneficial to monitor lighting performance where lighting is being provided for convenience. For example, in a large office building, it is a continual challenge to keep all luminaires operational. A system that could monitor the performance of these light fixtures would be very helpful in maintaining adequate light for occupants.

Summary of the Invention

The present invention provides a system for monitoring the performance of any luminaire and reporting problems or failures to a managing authority so that the proper corrective action can be implemented. For each lighting element or luminaire a sensor or sensors are provided that monitors the operational characteristics (e.g. both the electrical input and the output) of the luminaire. The sensors are capable of monitoring both voltage across the fixture and current travelling therethrough. Further, the sensors can monitor the relative voltage and current levels at both the input and output. In this manner a wide variety of problems can be detected. For example, a failure to detect current or voltage on the output side would indicate a broken or damaged bulb and/or a filament. Detecting unusual current readings could also indicate that the light, while functional, is not necessarily providing a sufficient degree of illumination. By also monitoring the current input into the luminaire, along with the voltage drop across the luminaire, the efficiency of that luminaire can be monitored. Variations in the determined efficiency can indicate that a failure is imminent, allowing for the replacement of the luminaire prior to an actual failure. In addition, the sensor is able to verify that power is being properly delivered to the input of the luminaire. Thus, if a failure should occur, maintenance personnel can

immediately be notified of what the actual problem is rather than having to further test the system upon arrival.

For each luminaire, a separate sensor or sensing system is provided. Therefore, the number of luminaires and sensors employed will be dependent upon the particular application.

5 For example, in a given ATM location, a single overhead light may be all that is required to provide sufficient illumination, hence, only one sensor is required. In most common traffic lights, three separate luminaires are provided for each direction of observation and each luminaire may include multiple bulbs. Thus, a separate sensing unit is provided for each bulb of each luminaire. As should be readily apparent, the number of luminaires and sensing units
10 employed in a given system can vary dramatically. Likewise, the system used to monitor the various sensing units can vary from simple to complex.

In one embodiment of the present invention a control system is provided that is electrically coupled to each of the sensing units being utilized. The control serves to operate the sensing unit and to gather information collected by the various sensors. In addition, it may be
15 more practical to periodically sense any given luminaire rather than taking continuous measurements. If this is the case, a control unit will then individually poll the various sensors at the allotted time to take the appropriate measurements. Depending upon the application being used, the control unit can be programmed to cause various remedial actions to occur if the sensors determine a problem. For example, in the context of an automatic teller machine, if it is
20 determined that insufficient illumination is provided to create a safe atmosphere, the control may cause the ATM to become disabled, thus preventing its subsequent use until the luminaire is repaired.

When a problem is detected, the control system in the present invention is caused to alert the appropriate personnel to the problem. In its simplest form, the control unit can simply be hard wired to a control panel within a maintenance room of a building. For various remote systems including traffic lights, street lights and diversely located ATMs, such a hard wiring scenario is not practical. In those cases, a control system is provided with a transmitter that sends the data to a receiver connected to a remote piece of monitoring equipment. The monitoring equipment can receive such signals from a large number of controlling units and hence monitor an even larger number of sensors. Thus, the single piece of monitoring equipment can effectively monitor the operative status of a large number of traffic lights over a large land area and when problems develop, initiate appropriate remedial action.

As yet another aspect of the present invention, the monitoring equipment may be connected to via a remote terminal by accessing a computer network such as the Internet. For example, a store owner using such sensors and a control unit to monitor the luminaires of a security system in a store during off-business hours, could simply access the Internet and obtain instantaneous results from the control unit relating to the operative status of the illumination system.

Once the system is implemented to effectively monitor the various luminaires, other equipment could similarly be monitored. For example, by providing appropriate sensing units in a computer system, signals could be produced indicating whether sufficient power is being supplied. By having this equipment attached to the monitoring network, appropriate use signals could be remotely or locally provided to initiate remedial action when necessary. For example, should main power be interrupted an appropriate signal could be provided to a system administrator's pager indicating that some attention is necessary. Many other examples exist

where the monitoring of power supplies and electrical characteristics can provide useful information to various operators or service personnel.

It is an object of the present invention to provide a sensor for a luminaire to determine its operative status.

5 It is a further object of the present invention to provide a sensing unit connected to both the input and the output of a luminaire.

It is still yet another object of the present invention to provide the sensing unit coupled to a luminaire that measures both current and voltage at both an input and an output.

10 It is yet still another object of the present invention to provide a control unit coupled to one or more sensing units to control the sensing units and gather data.

It is still yet a further object of the present invention to couple a transmitter to the control unit so that the control unit can provide data to a remote location.

Brief Description of the Drawings

15 Figure 1 is a block diagram schematically illustrating the monitoring and sensing system of the present invention.

Figure 2 is a schematic illustration of the monitoring and testing system of the present invention as used with three different types of luminaires.

Figure 3 is a schematic illustration of a sensor of the present invention connected to a florescent lamp.

Detailed Description of the Preferred Embodiment

Referring to Figure 1, a light monitoring system is illustrated and is generally referred to as 10. Light monitoring system 10 is associated with one or more luminaires 15, 20, 25. Such luminaires 15, 20, 25 represent any lighting element that would benefit from being monitored. For example, such lighting elements could be within traffic lights, street lights, ATM illumination systems or other security systems. Of course, there are any number of reasons to monitor a plethora of different lighting systems that the present invention is applicable to.

As illustrated, each luminaire 15, 20, 25 has an input 30 and output 35. Input 30 is coupled to an appropriate power source 40 while output 35 is coupled to ground. In most cases, power source 40 will simply be line voltage. However, the present invention also relates to systems using battery power. Thus, input 30 and output 35 simply represent the power supply to luminaires 15, 20, 25 but can also represent the control line for actuating and controlling those same luminaires.

For each luminaire 15, 20, 25 an independent sensing unit 45, 50, 55 is respectively coupled thereto. As illustrated, each sensing unit 45, 50, 55 is coupled to both the input 30 and output 35 of each luminaire 15, 20, 25. Of course, while three sensing units and three luminaires have been illustrated, any number can actually be employed depending upon the system in use. Furthermore, while it is preferable to have an independent sensing unit coupled to each luminaire, it is possible to have a single sensing unit coupled to a plurality of luminaires wherein that particular sensing unit simply cycles through its various inputs in the different luminaires.

Each sensing unit 45, 50, 55 is capable of measuring both current and voltage at both input 30 and output 35. This allows sensing units 45, 50, 55 to determine whether each of

luminaires 15, 20 and 25 are operating properly and if not operating properly, to accurately determine what the particular problem is. For example, if no current is received at output 35 at a time when it should be, and proper power levels are detected at input 30, then the appropriate sensor 45, 50, 55 determines that power is not flowing through the particular luminaire 15, 20, 25. The most common cause for such a problem would be a broken filament or an otherwise inoperative bulb. A more extreme cause would be actual physical damage to the luminaire itself, such as a cut or severed wire. If the appropriate levels of current or voltage are not detected at input 30, then sensing unit 45, 50, 55 determines that the problem lies with the power source 40. Finally, if voltage or current levels are detected at output 35 that are lower than they should be, then sensing unit 45, 50, 55 determines that there is a problem with luminaire 15, 20, 25 that may require maintenance in the future. For example, as the efficiency of any given luminaire 15, 20, 25 decreases it may be indicative of an imminent failure. It is possible for sensing unit 45, 50, 55 to determine the operative illumination of luminaires 15, 20, 25 to determine whether the problem needs immediate attention or can be delayed for some time.

Operatively coupled to each sensing unit 45, 50, 55 is a control unit 60. While one control unit 60 is illustrated for three sensing units 45, 50, 55 it is to be understood that the particular number and arrangement of control units 60 is variable. For example, each sensing unit 45, 50, 55 could be incorporated with its own control unit. Control unit 60 acts to cause sensing units 45, 50, 55 to take measurements at the appropriate times. For example, sensing units 45, 50, 55 could take continuous measurements from each luminaire 15, 20, 25 or could take such measurements at any predetermined interval. Furthermore, control unit 60 could cause sensing unit 45, 50, 55 to take measurements at different intervals if any type of problem is detected with one or more of the luminaires 15, 20, 25. For example, if it is determined that light

fixture 15 is operating less efficiently than it should, sensing unit 45 may be caused to take more frequent measurements because it is assumed that some type of failure is imminent.

Control unit 60 can be coupled to an associated system 80. Associated system 80 is generally representative of the system relying on luminaire 15, 20, 25. For example, in the context of a traffic light, associated system 80 would include the traffic signal and its control system. In the context of an ATM, associated system 80 would be the control system controlling the ATM and/or any locking mechanisms surrounding it. Thus, the various luminaires can be integral with or separate from associated system 80. Control unit 60 can be programmed to take remedial action through associated system 80 if a significant problem is determined in any luminaire 15, 20, 25. For example, assuming use with an ATM machine, if it is determined that insufficient illumination is provided, control unit 60 may cause the ATM to become inoperative and where appropriate, access to that ATM machine may be prevented. This occurs when control unit 60 sends an appropriate instruction to associated system 80.

Control unit 60 is operatively coupled to monitoring equipment 75. Monitoring equipment 75 is used to alert the appropriate maintenance personnel to the status of, and indicate any failures of luminaires 15, 20, 25. In the simplest form, control unit 60 may simply be hard wired to monitoring equipment 75. In many cases however this simply will not be practical, such as when light monitoring system 10 is used to monitor traffic lights, street lights or illumination systems in remote ATM units. In such cases, control unit 60 is provided with transmitter 65 which is capable of transmitting data to receiver 70 that is operatively coupled to monitoring equipment 75. Monitoring equipment 75 can in this manner monitor the receipt of data from a plurality of control units 60. When appropriate or desired, transmitter 65 and receiver 70 can be fabricated as transceivers so that monitoring equipment 75 can send signals to

control unit 60 to further test the luminaire 15, 20, 25 or to control the above-noted associated systems.

Monitoring equipment 75 can be configured so as to allow remote access via a computer network, such as the Internet. In such a case, an operator can utilize a computer to access monitoring equipment 75 to determine the status of various luminaire 15, 20, 25. This allows for convenient and remote access to light monitoring system 10 without requiring a dedicated piece of equipment. In such a context, monitoring equipment 75 can actually be physically incorporated with control unit 60. Thus, a relatively small piece of equipment can be coupled to important luminaire and provide data to a remote observer.

As an illustrative example, assume the element within luminaire 15 breaks due to continued use over time. Power source 40 continues to deliver appropriate levels of current and voltage to luminaire 20 and 25. These power levels are also measurable at input 30 by sensing unit 45. However, sensing unit 45 will not detect any current or voltage levels at output 35. Thus, sensing unit 45 provides these measurements to control unit 60. Control unit 60 then determines that the lighting element within light fixture 15 has become inoperative. In this example, luminaires 15, 20, 25 represent a typical traffic signal. When control unit 60 determines that luminaire 15 has become inoperative (and assuming no back up exists) control unit 60 may initiate appropriate remedial action through associated system 80. For example, with one luminaire 15 not functioning, it may be appropriate to cause a traffic signal to flash red. While possibly an inconvenience to passing motorists, it provides the safest condition until the traffic signal can be repaired. As this occurs, control unit 60 sends data indicating luminaire 15 is inoperative to monitoring equipment 75. Once so received, the appropriate maintenance personnel can determine that repair is required and dispatch the appropriate personnel to the

traffic signal to repair luminaire 15. Once so repaired, sensing unit 45 is able to verify that luminaire 15 is functioning properly. Thus, control unit 60 can automatically revert the traffic signal back to its normal status. Alternatively, rather than programming control unit 60 to so control the traffic signal, such decisions can be made by observing personnel and passed to control unit 60 from monitoring equipment 75.

In addition to the monitoring of luminaires, the present system can be easily configured to monitor electrical characteristics of other components. For example, the power conditions of a computer system could easily be monitored. By providing a sensing unit which measures both relative voltage levels and electrical current, the functional characteristics of the computer system can be monitored. This type of sensing system can easily be connected to the control unit 60 and all other associated equipment. In this way, useful information regarding all types of electrically powered equipment can be utilized.

Referring to Figure 2, a monitored system 100 is illustrated to show how the present monitoring and sensing system might interact with three different types of luminaires. As before, a power source 40 feeds current into the system. Control unit 60 is provided and may have a separate power line 140 for its own power supply. A florescent luminaire 105 is provided as a light source. Florescent luminaire includes a plurality of florescent lamps 120 that are operatively coupled to lamp ballast 122 in the known way. Sensor 45 is provided and is disposed between power source 40 and the various florescent lamps 120. Coupled to each florescent lamp 120 is a photo sensor 125 that is connected to sensor 45.

An incandescent luminaire 110 is provided. Sensor 50 is disposed between power source 40 and incandescent luminaire 110 as illustrated. In addition, photosensor 130 is provided

adjacent to incandescent luminaire 110 and operatively coupled to sensor 50. As power is delivered from power source 40, sensor 50 can determine whether the desired levels of voltage and current are being provided. Sensor 50 is also coupled to the input and the output of the incandescent luminaire 110. Thus, current and voltage levels delivered through incandescent luminaire 110 are detected by sensor 50. As previously explained, any deviations from a preestablished norm will cause the sensor to report the appropriate problem. Photosensor 130 is located in close proximity to incandescent luminaire 110. In its simplest form, photosensor 130 can detect whether any light is being emitted from incandescent luminaire 110. This information is gathered by sensor 50 and reported to control unit 60. Photosensor 130 is also capable of detecting the level of illumination generated by incandescent luminaire 110. Thus, not only is it possible to detect an absolute failure, it is possible to determine if incandescent luminaire 110 is performing below a desired level. This will allow incandescent luminaire 110 to be replaced before it becomes critical.

LED luminaire 150 is also provided and includes sensor 55 interposed between power source 40 and each of the individual LEDs. Sensor 55 monitors the current and voltage levels being delivered to and passing through each of the various LEDs. To simplify the system, sensor 55 can simply detect the current and voltage levels being delivered to and passing through the entire set of LEDs rather than individually monitoring each LED. That is, with a large number of individual lights, it may simply be easier to monitor sets of those lights rather than each individual element.

The data gathered by each of sensors 45, 50 and 55 is delivered to control unit 60 either by a hard line connection or by receiving transmitted data. Telephone line 135 is coupled to control unit 60 so that remote monitoring and control can be established. A supplemental sensor

S1 is provided in line with power source 40 to determine power levels being delivered to the system as a whole. As previously explained, control unit 60 can be coupled to an associated system 80 (as illustrated in Figure 1). Thus, in addition to simply monitoring the status of the various luminaires, control unit 60 can cause various events to occur when errors are detected.

5 Figure 3 is an illustration of one florescent lamp 120 from florescent luminaire 105. Sensor 45 is provided with a power source connection 150 which delivers power from power source 40. Connections are then made to the various terminals of florescent lamp 120 as well as ballast 122 so that current is appropriately provided while initially illuminating florescent lamp 120 and maintaining that illumination. As previously explained, sensor 45 monitors the current
10 and voltage levels being delivered to ballast 122 and florescent lamp 120 as well as monitoring what is passing through ballast 122 and florescent lamp 120. In addition, a photosensor 125 is attached to a portion of each florescent lamp 120 to actually detect whether florescent lamp 120 is illuminated and, if desired, at what level of illumination florescent level 120 is providing. This information is again passed to sensor 45 and ultimately to control unit 60.

15 Those skilled in the art will further appreciate that the present invention may be embodied in other specific forms without departing from the spirit or central attributes thereof. In that the foregoing description of the present invention discloses only exemplary embodiments thereof, it is to be understood that other variations are contemplated as being within the scope of the present invention. Accordingly, the present invention is not limited in the particular
20 embodiments which have been described in detail therein. Rather, reference should be made to the appended claims as indicative of the scope and content of the present invention.

CLAIMS

I claim:

1. A monitoring system for a luminaire, comprising:
 - a sensing unit attached to the luminaire so that the sensing unit can measure the electrical operating characteristics of the luminaire;
 - a control unit operatively coupled to the sensing unit to receive measurements from the sensing unit;
 - a monitor operatively coupled to the control unit to display an indication of the operative status of the luminaire.
2. The monitoring system of Claim 1 wherein the electrical operating characteristics include the current and voltage at each of the input and the output;
3. The monitoring system of claim 1, further comprising:
 - a transmitter coupled to the control unit for transmitting data indicative of a functional status of the luminaire;
 - a receiver coupled to the monitor for receiving the data transmitted from the control unit through the transmitter so that the monitor can display the indication of the operative status of the luminaire.
4. The monitoring system of claim 1 wherein the monitor is operatively coupled to the Internet so that remote access is provided to the monitor.
5. The monitoring system of claim 1 wherein the control unit acts to control an associated system, that is associated with the luminaire, when the control unit determines that the luminaire is inoperative.
6. The monitoring system of claim 5 wherein the associated system is a traffic signal.
7. The monitoring system of claim 5 wherein the associated system is a street light.
8. The monitoring system of claim 5 wherein the associated system is an automatic teller machine.

Fig 1

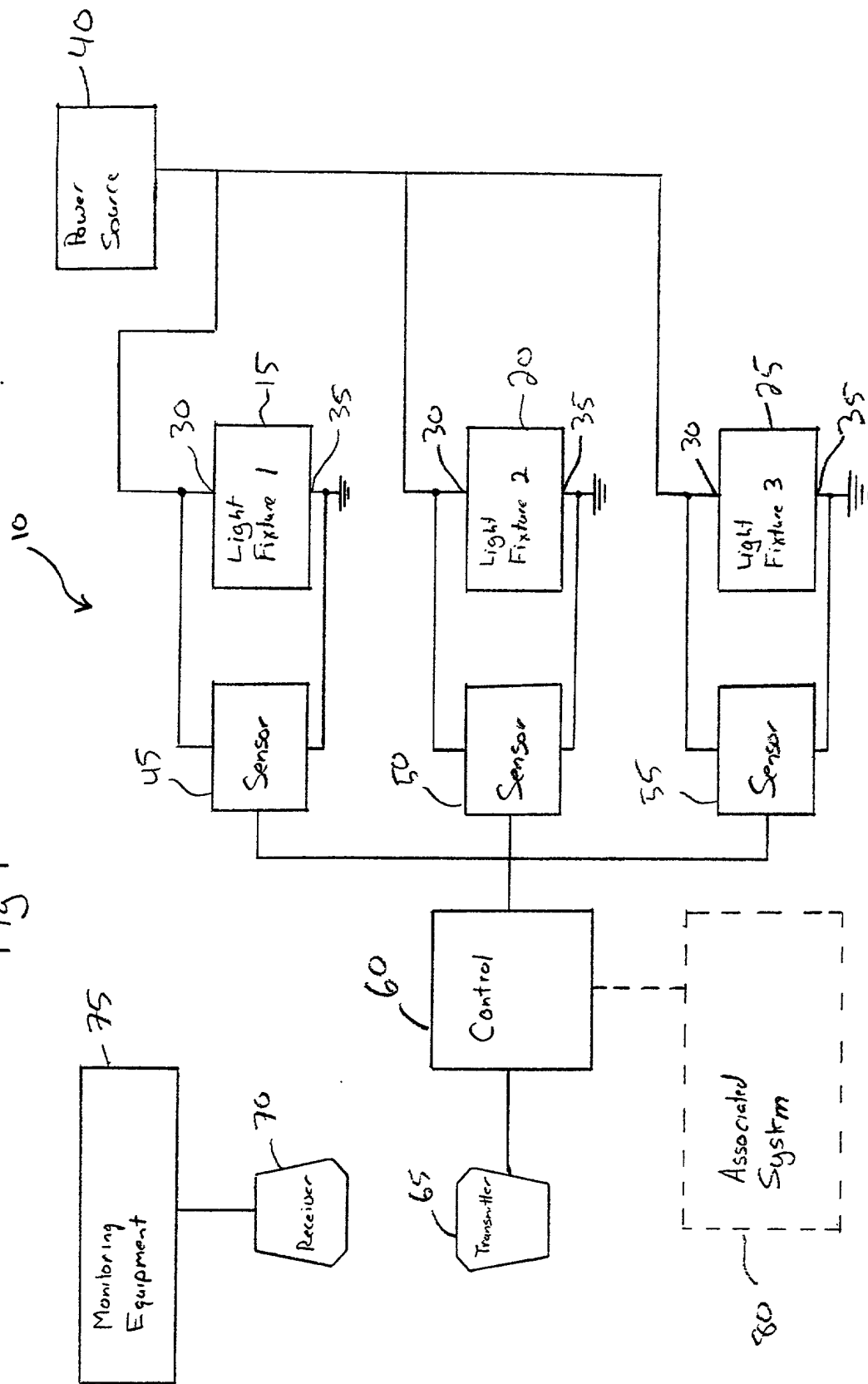


Figure 2

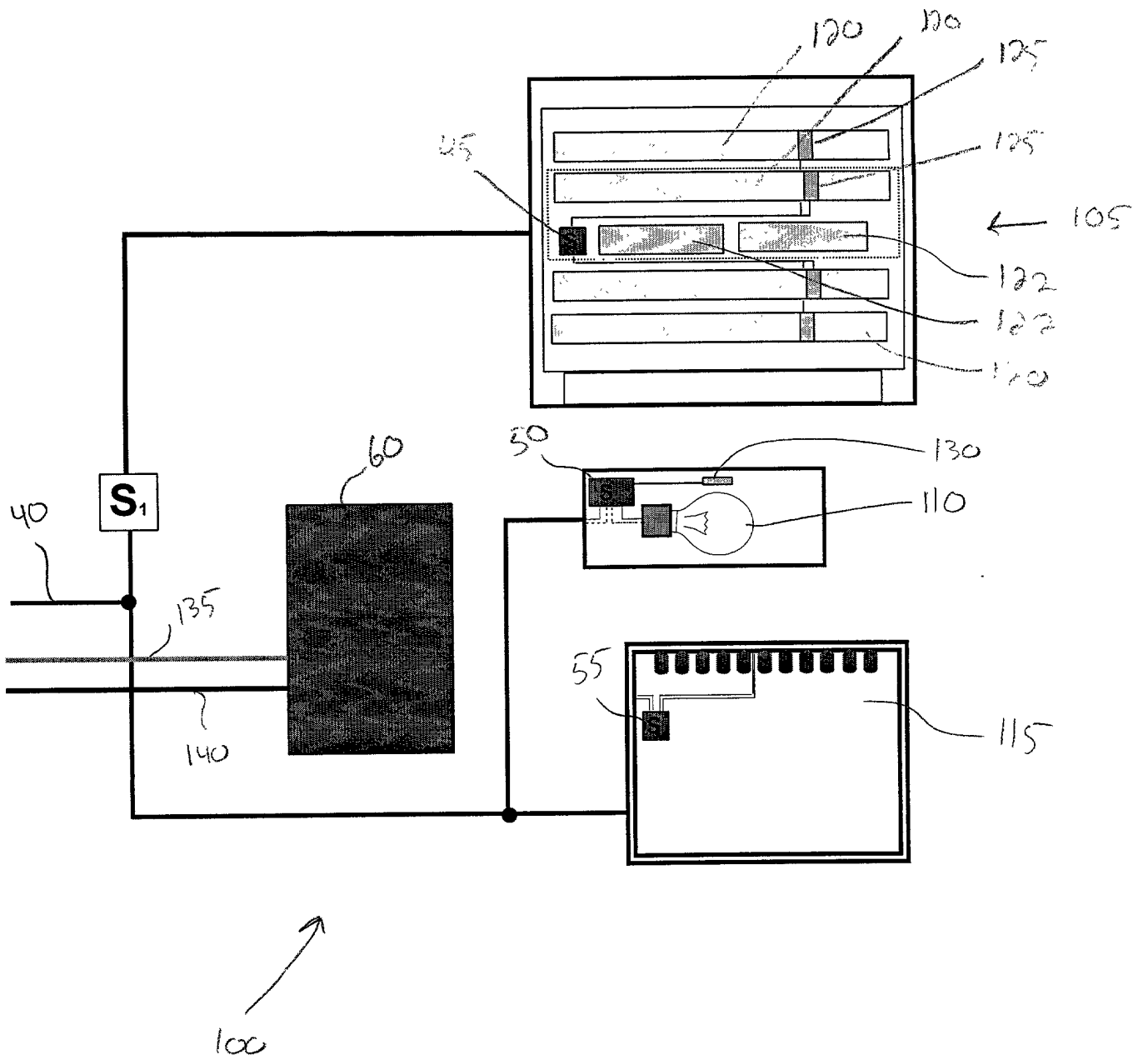
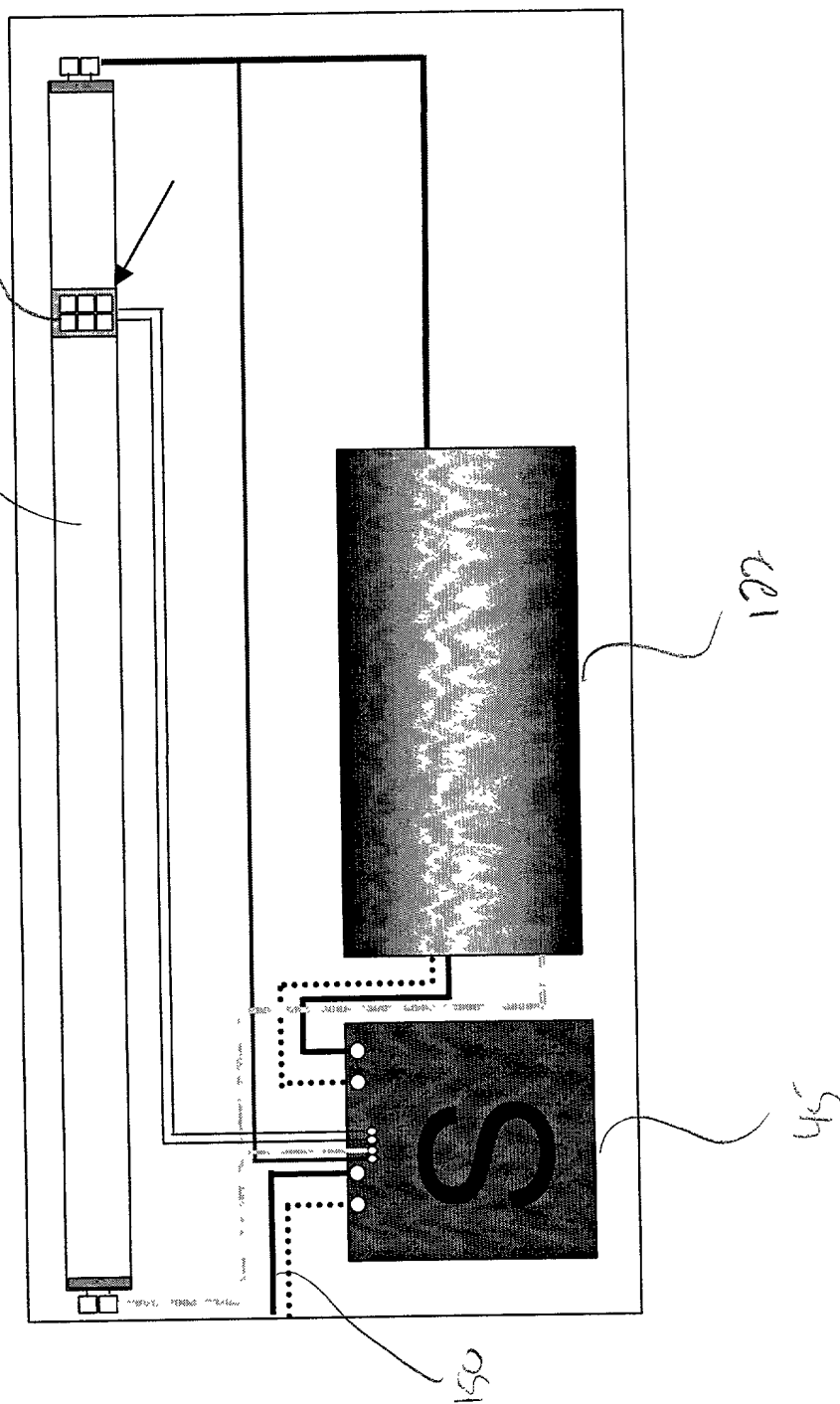


FIG. 3



SOLE INVENTOR

DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY

As the below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled: SYSTEM OF MONITORING AND TESTING OF LIGHT SOURCES, the specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Sec. 1.56(a).

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorneys to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

OPPENHEIMER WOLFF & DONNELLY LLP

Harold D. Jastram, Reg. No. 19,777

Alan Kamrath, Reg. No. 28,227

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Send correspondence to: Craig J. Lervick, Oppenheimer Wolff & Donnelly LLP, Plaza VII, Suite 3400, 45 South Seventh Street, Minneapolis, MN 55402. Direct telephone calls to Craig J. Lervick at (612) 607-7387.

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole inventor: James S. Bernardo

Inventor's Signature 

7/31/2000
Date

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